Proposal for SPP 1144, 3rd phase

Geophysical study of the Logatchev HYDROthermal vent field and its magmatic PLUMBing system

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The overall goal of the proposed project is to investigate the relationship between the occurrence of hydrothermal vent sites, the crustal structure, and the deep-seated magmatic plumbing system. The study area is the northern survey area of the SPP1144, i.e., the Mid-Atlantic Ridge to the south of the Fifteen-Tweenty transform fault and includes the prominent Logatchev hydrothermal vent field. The fluid chemistry of the Logatchev vents suggest that seawater reaches down to mantle depth and causes serpentinization of the mantle. Geophysical techniques will be used during Maria S. Merian cruise MSM10/2 to search for evidence indicating the existence of serpentinization under the the vent field using seismic P- and S-wave velocity and electrical conductivity as key parameters. Active seismics using airguns, ocean bottom seismometers, and a deep tow streamer will be used to study the structure of the crust and upper most mantle in two-dimensions. Passive seismology (deployment during MSM06/2; time on the seafloor ~ 12 month) will locate active faults and hence pathways for hydrothermal fluids by detecting local earthquakes that align along faults. Electromagnetic measurements and measurements of the compliance will resolve regions of anomalously low shear strength and low electrical resistivity beneath the spreading axis. Such regions are indicative for the presence of partial melt with varying melt connectivity. The joint analysis and interpretation of all data will allow us to resolve the two- and three-dimensional structure of regions containing partial melt and melt lenses within the crust or at the crust/mantle boundary. In addition, the crustal porosity structure and faults will be imaged. Our study will thus provide elementary information on where and how fluids, magma and heat is transported from the mantle to the seafloor and crustal structrual models can be related to the location of the Logatchev vent sites on the surface.